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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/965,370	09/26/2001	Hua Chung	APPM/6303/CPI/COPPER/PJS	6507

7590 03/31/2008  
Patent Counsel  
Applied Materials, Inc.  
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EXAMINER
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STOUFFER, KELLY M

ART UNIT	PAPER NUMBER
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1792

MAIL DATE	DELIVERY MODE
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03/31/2008

PAPER

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* HUA CHUNG, LING CHEN,  
JICK YU, and MEI CHANG

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Appeal 2008-0206  
Application 09/965,370  
Technology Center 1700

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Decided: March 31, 2008

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Before BRADLEY R. GARRIS, CHUNG K. PAK, and  
JEFFREY T. SMITH, *Administrative Patent Judges*.

SMITH, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal from the Primary Examiner's rejection of claims 42, 44-52, 60-62, and 64-66. Claims 1-7, 9, 10, 39, 53-59, 63, and 67-69 are the only other claims pending in this application; however, Appellants have withdrawn the appeal of these

claims.<sup>1</sup> (Br. 4). Although the rejection appealed from is a non-final rejection, we have jurisdiction under 35 U.S.C. §§ 6 and 134 since the claims on appeal have been twice presented and rejected. *See Ex parte Lemoine*, 46 USPQ2d 1420, 1423 (BPAI 1998).

Representative claim 42, as presented in Appellants' Brief, is reproduced below:

42. A method of filling a feature, comprising:  
depositing a barrier layer by atomic layer deposition, the barrier layer having a thickness of less than about 20 Å;  
depositing a copper alloy seed layer over the barrier layer, the copper alloy seed layer comprising copper and a metal in a concentration between about 0.01 atomic percent and 5.0 atomic percent, the metal selected from the group consisting of aluminum, magnesium, zirconium, and combinations thereof; and  
then depositing a copper conductive material layer over the copper alloy seed layer.

The Examiner relies on the following references in rejecting the appealed subject matter:

Kobayashi	5,023,698	Jun. 11, 1991
Lopatin (Lopatin '799)	6,174,799 B1	Jan. 16, 2001
Tsai	6,309,964 B1	Oct. 30, 2001
Lopatin (Lopatin '954)	6,368,954 B1	Apr. 9, 2002

I. Claims 42, 44-52, 60-62, and 64-66 stand rejected under 35 U.S.C. § 103(a) as obvious over Lopatin, (Lopatin '954), Lopatin, (Lopatin '799) and Kobayashi.

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<sup>1</sup> Appellants' arguments in traversal of the Examiner's rejections appear in the Reply Brief filed March 22, 2007. We will refer to this brief using the "Br." designation.

II. Claims 42, 44-52, 60-62, and 64-66 stand rejected under 35 U.S.C. § 103(a) as obvious over obvious over Lopatin, (Lopatin ‘954), Lopatin, (Lopatin ‘799), Tsai, and Kobayashi.

Appellants’ invention relates to a method of filling a feature of a semiconductor device comprising depositing a barrier layer by atomic layer deposition and depositing a seed layer comprising copper and another metal over the barrier layer. (Spec. ¶ [0001]).

Appellants’ arguments regarding the rejections over Lopatin ‘954, Lopatin ‘799 and Kobayashi are directed to claim 42. Appellants do not present separate arguments for claims 44-52, 60-62, and 64-66. Accordingly, claims 44-52, 60-62, and 64-66 will stand or fall together with claim 42.<sup>2</sup>

We have thoroughly reviewed each of the arguments advanced by Appellants. However, we are in complete agreement with the Examiner's reasoned analysis and application of the prior art. Accordingly, we will adopt the Examiner's reasoning as our own in sustaining the rejections of record, and we add the following for emphasis only.

Appellants maintain that the combination of Lopatin ‘954, Lopatin ‘799, and Kobayashi does not teach or suggest that the amounts of aluminum that Kobayashi includes in copper metallization layers to prevent corrosion of the copper layers may be added to the nitrogen and aluminum-containing copper seed layer

<sup>2</sup> The identification of elements of a claim followed by the statement that the references “do not teach or suggest all the elements of the claims...” is not a separate argument that explains why the features of the references identified by the Examiner's do not render the claimed subject matter obvious.

that Lopatin '799 provides to enhance adhesion to a barrier layer.  
(Br. 6).

The Examiner has determined that Lopatin '954 describes the process for forming a barrier layer by an ALD process to a thickness of 20-300 Å which is covered by a copper containing seed layer. (Answer 5). Appellants have not argued that this disclosure of Lopatin '954 would not have suggested the claim 42 thickness of less than about 20 Å to a person of ordinary skill in the art. The Examiner recognized that Lopatin '954 did not describe the other metals included in the seed layer. The Examiner cited Lopatin '799 for describing seed layers comprising copper and other metals, such as aluminum and magnesium. Lopatin '799 discloses the copper seed layers of copper alloyed with aluminum or magnesium result in increased adhesion to the barrier layer and decreases the electro-migration. (Col. 2, l. 61- col. 3, l. 15). The Examiner reasonably concluded that a person of ordinary skill in the art would have been motivated to utilize the copper aluminum seed layer of Lopatin '799 to obtain increased adhesion to the barrier layer of Lopatin '954 and decreased electro-migration. (Answer 5). The Examiner cited Kobayashi for describing layers comprising copper and aluminum within the claimed atomic ratios result in improved electro-migration resistance. (Answer 6). Appellants have not argued that the concentration of copper and aluminum described by Kobayashi is not between about 0.01 atomic percent and 5.0 atomic percent as required by claim 42. The Examiner reasonably concluded that a person of ordinary skill in the art would have been motivated to

utilize a copper and aluminum seed layer comprising the claimed atomic ratio of copper to aluminum to obtain decreased electro-migration. The subject matter of Lopatin '954, Lopatin '799, and Kobayashi are all directed towards semiconductor devices.

Although Lopatin '799 does not specify the atomic ratio of copper to aluminum in the seed layer, a person of ordinary skill in the art would have selected the amount of aluminum to add to the seed layer to result in improved adhesion and to obtain decreased electro-migration as suggested by Lopatin '799. Kobayashi is further evidence that the addition of aluminum in an amount of about 0.01 atomic percent and 5.0 atomic percent would have resulted in decreased electro-migration. Appellants have not asserted that the addition of aluminum in the claimed ratio amount of about 0.01 atomic percent and 5.0 atomic percent would not have resulted in decreased electro-migration or improved adhesion to the barrier layer.

Thus, a person of ordinary skill in the art following the teachings of Lopatin '954, Lopatin '799, and Kobayashi would have been motivated to form a barrier layer by an ALD process to a thickness of less than about 20Å which is covered by a copper and aluminum- containing seed layer comprising the claimed atomic ratio of copper to aluminum even if for a different reason than that intended by Appellants. For a prima facie case of obviousness to be established, references need not recognize the problem solved by the appellants. *See In re Kemps*, 97 F.3d 1427, 1430 (Fed. Cir. 1996); *In re Beattie*, 974 F.2d 1309, 1312 (Fed. Cir. 1992).

Claims 42, 44-52, 60-62, and 64-66 stand rejected under 35 U.S.C. § 103(a) as obvious over obvious over Lopatin '954, Lopatin '799, Kobayashi, and Tsai. In response to this rejection, Appellants rely on the same reasons presented in the discussion of the rejection over Lopatin '954, Lopatin '799, and Kobayashi. (Br. 9-10). Appellants have not presented additional specific arguments regarding the Examiner's obviousness rejection. In support of the stated rejection, the Examiner has presented specific statements regarding the knowledge of persons of ordinary skill in the art in combining Tsai with the other cited references. (*See Answer 6-7*). Appellants have not refuted the Examiner's position. Thus, for the reasons presented in our discussion of the rejection above, and the reasons presented by the Examiner, we will uphold this rejection.

In conclusion, based on the foregoing and the reasons well stated by the Examiner, the Examiner's decision rejecting the appealed claims is affirmed.

#### ORDER

The rejections of claims 42, 44-52, 60-62, and 64-66 under 35 U.S.C. § 103(a) as obvious over Lopatin '954, Lopatin '799, and Kobayashi; as well as the rejection over Lopatin '954, Lopatin '799, Kobayashi, and Tsai are AFFIRMED.

Appeal 2008-0206  
Application 09/965,370

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

tf/clj

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